

(12) **United States Patent**  
**Li et al.**

(10) **Patent No.: US 10,004,271 B2**  
(45) **Date of Patent: Jun. 26, 2018**

(54) **ATOMIZER AND ELECTRONIC SMOKING  
DEVICE HAVING SAME**

(71) Applicant: **Shenzhen First Union Technology Co.,  
Ltd.**, Shenzhen, Guangdong Province  
(CN)

(72) Inventors: **Yonghai Li**, Shenzhen (CN); **Zhongli  
Xu**, Shenzhen (CN); **Shuyun Hu**,  
Shenzhen (CN)

(73) Assignee: **SHENZHEN FIRST UNION  
TECHNOLOGY CO., LTD.**,  
Shenzhen, Guangdong Province (CN)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days. days.

(21) Appl. No.: **15/390,480**

(22) Filed: **Dec. 24, 2016**

(65) **Prior Publication Data**  
US 2017/0105453 A1 Apr. 20, 2017

(30) **Foreign Application Priority Data**  
Dec. 25, 2015 (CN) ..... 2015 1 0985835

(51) **Int. Cl.**  
**A24F 47/00** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **A24F 47/008** (2013.01)

(58) **Field of Classification Search**

CPC .... A24F 47/008; A24F 47/004; A24F 47/002;  
A24F 7/02; F16J 15/022; H05B 6/36;  
H05B 6/362; H05B 6/108; F22B 1/284;  
F16K 15/025  
USPC ..... 131/329, 194, 271, 273; 128/202.21  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|              |     |         |     |       |                        |
|--------------|-----|---------|-----|-------|------------------------|
| 2014/0334803 | A1* | 11/2014 | Li  | ..... | H05B 3/03<br>392/394   |
| 2015/0250231 | A1* | 9/2015  | Hon | ..... | A24F 47/008<br>131/329 |
| 2016/0135505 | A1* | 5/2016  | Li  | ..... | H05B 3/44<br>131/329   |

\* cited by examiner

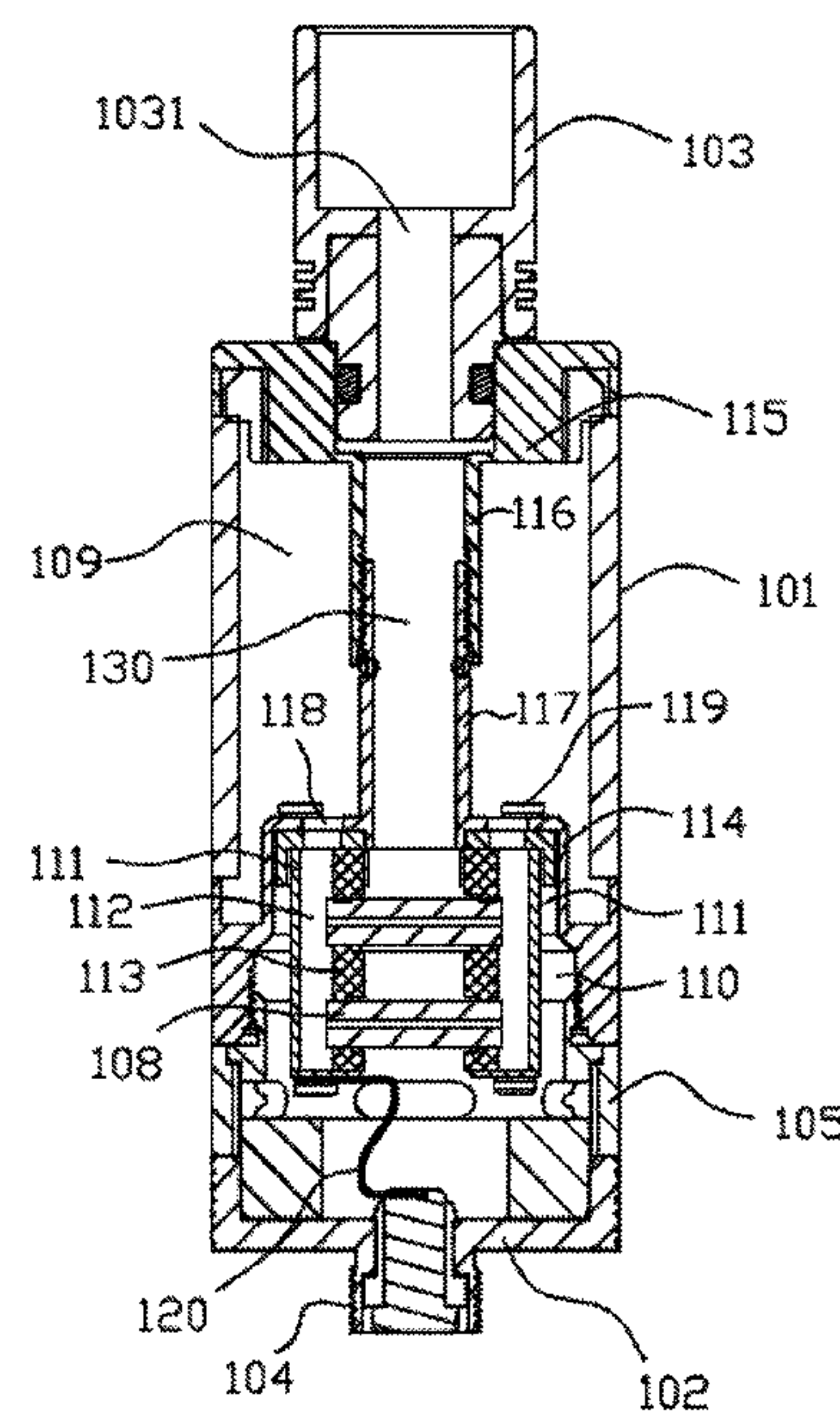
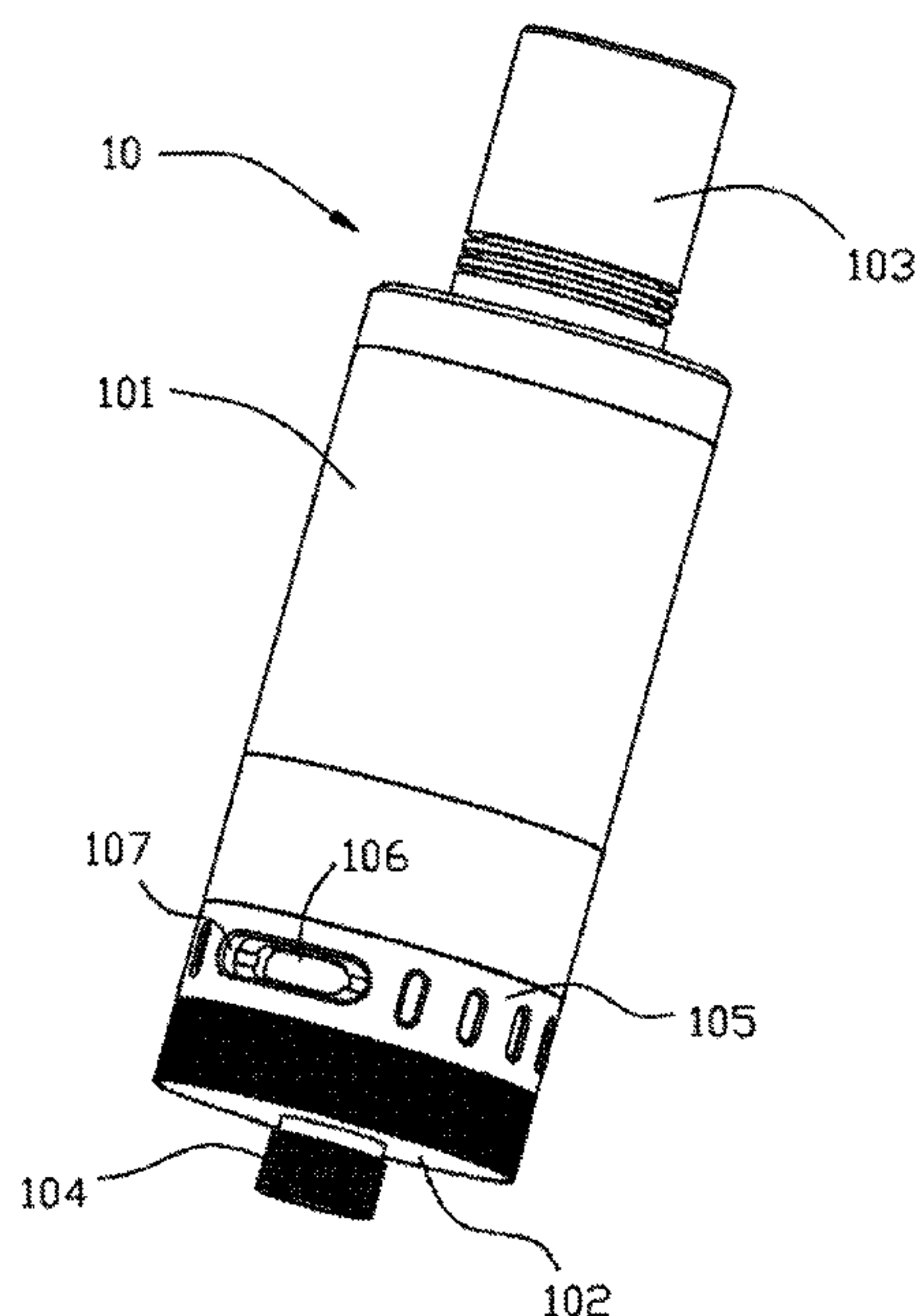
*Primary Examiner* — Edwin A. Leon

(74) *Attorney, Agent, or Firm* — Cheng-Ju Chiang

(57) **ABSTRACT**

An exemplary atomizer includes a housing, a conductive part at an end of the housing, a mouthpiece with an air outlet, a liquid chamber, and at least one heating element. The liquid chamber is in the housing and configured for storing tobacco liquid. The at least one heating element is electrically connected to the conductive part. The heating element includes a liquid carrier and a heating part integrally formed with the liquid carrier. The liquid carrier has a micro porous structure. The liquid carrier is in contact with the tobacco liquid. The liquid carrier is configured for absorbing the tobacco liquid, and the heating part is configured for heating the tobacco liquid to form aerosol.

**10 Claims, 8 Drawing Sheets**



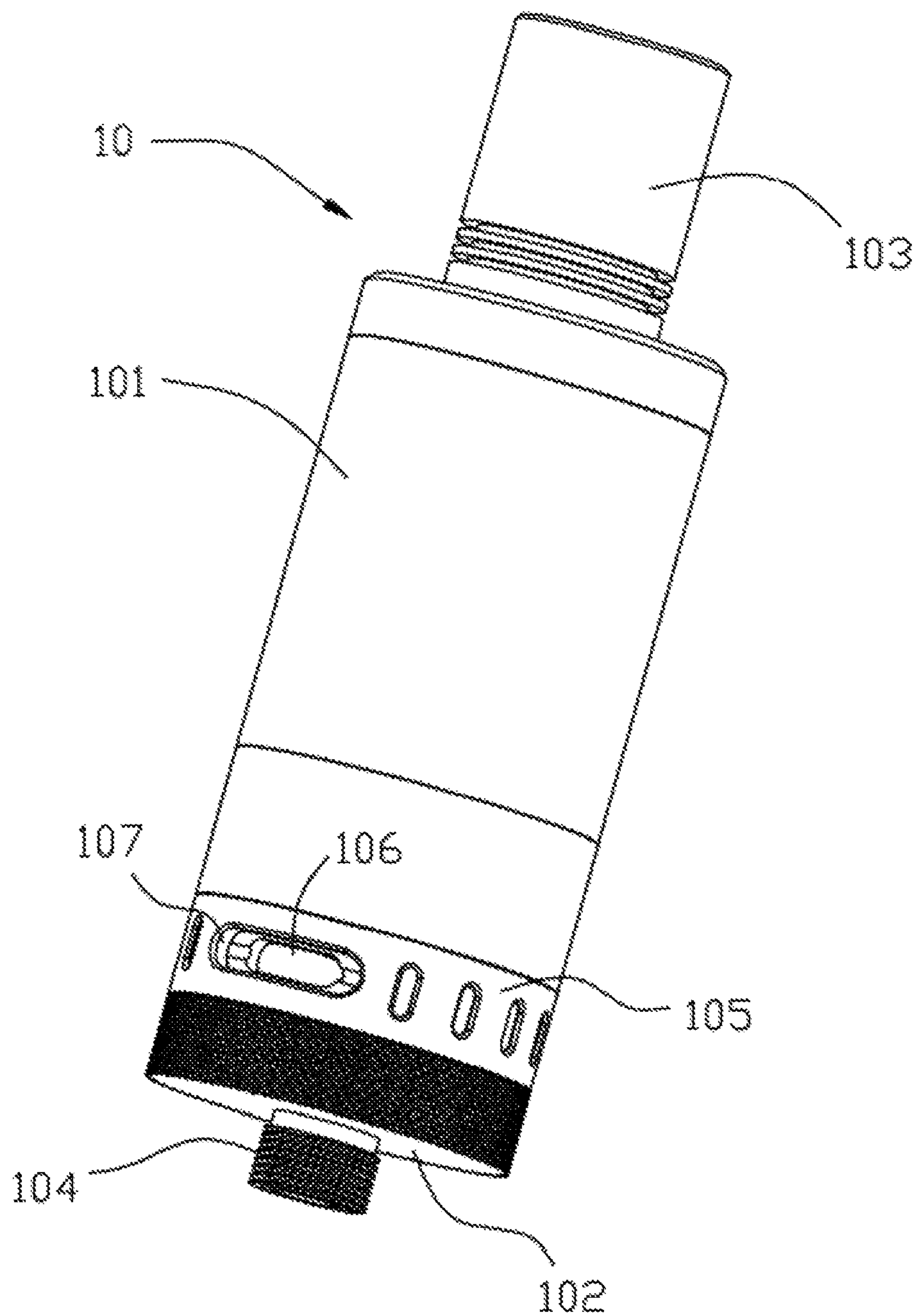


FIG. 1

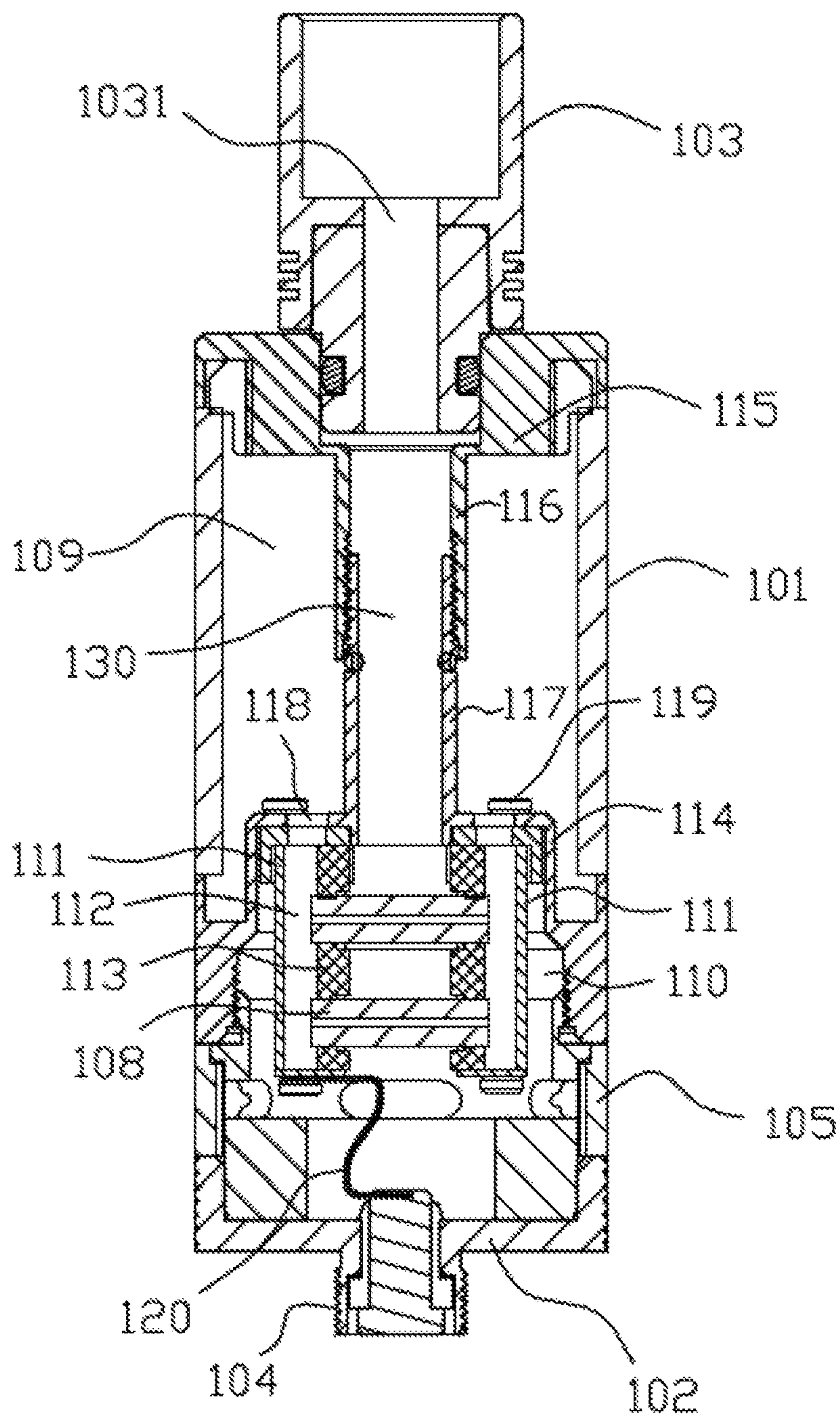


FIG. 2



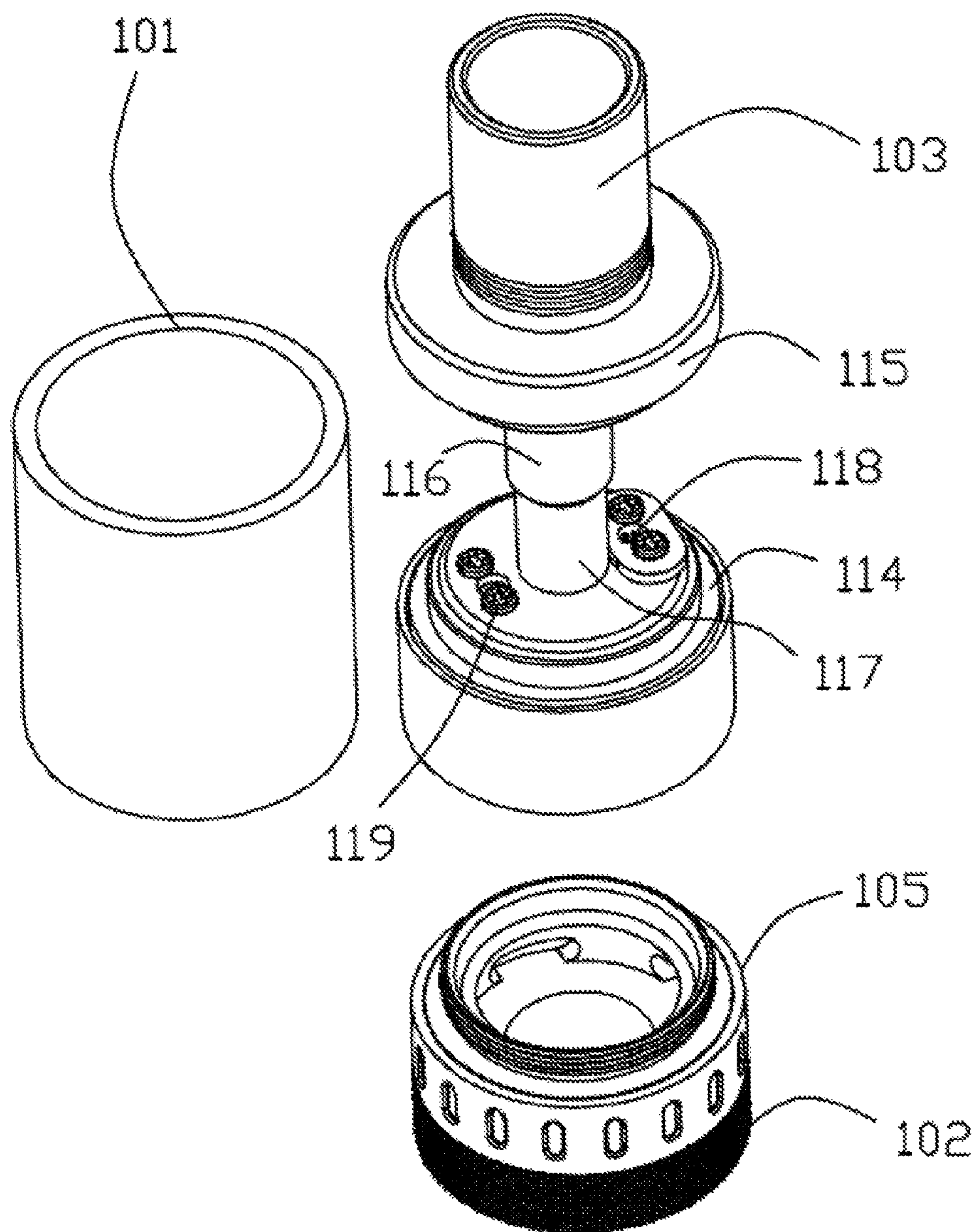


FIG. 3

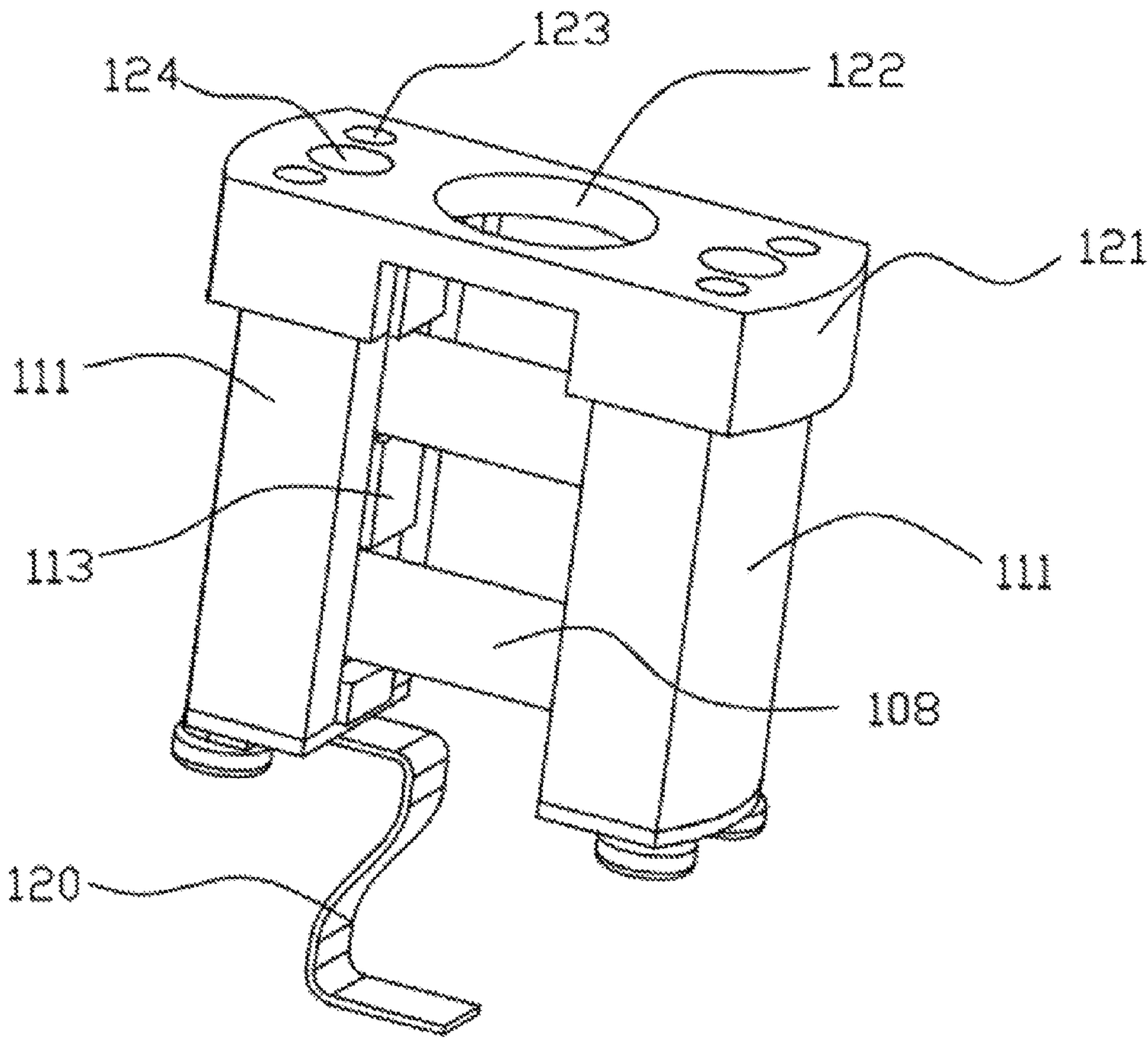


FIG. 4

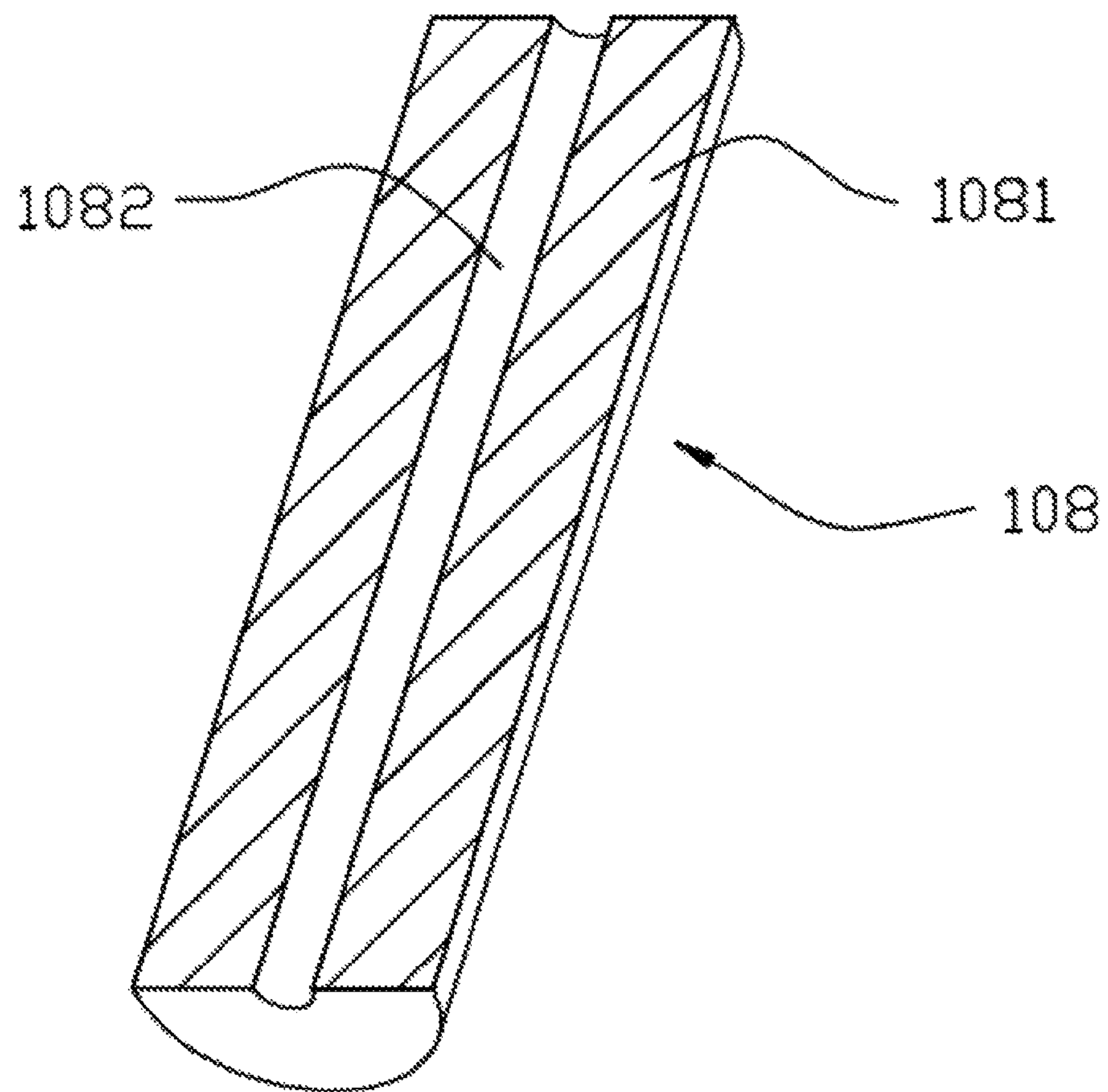


FIG. 5

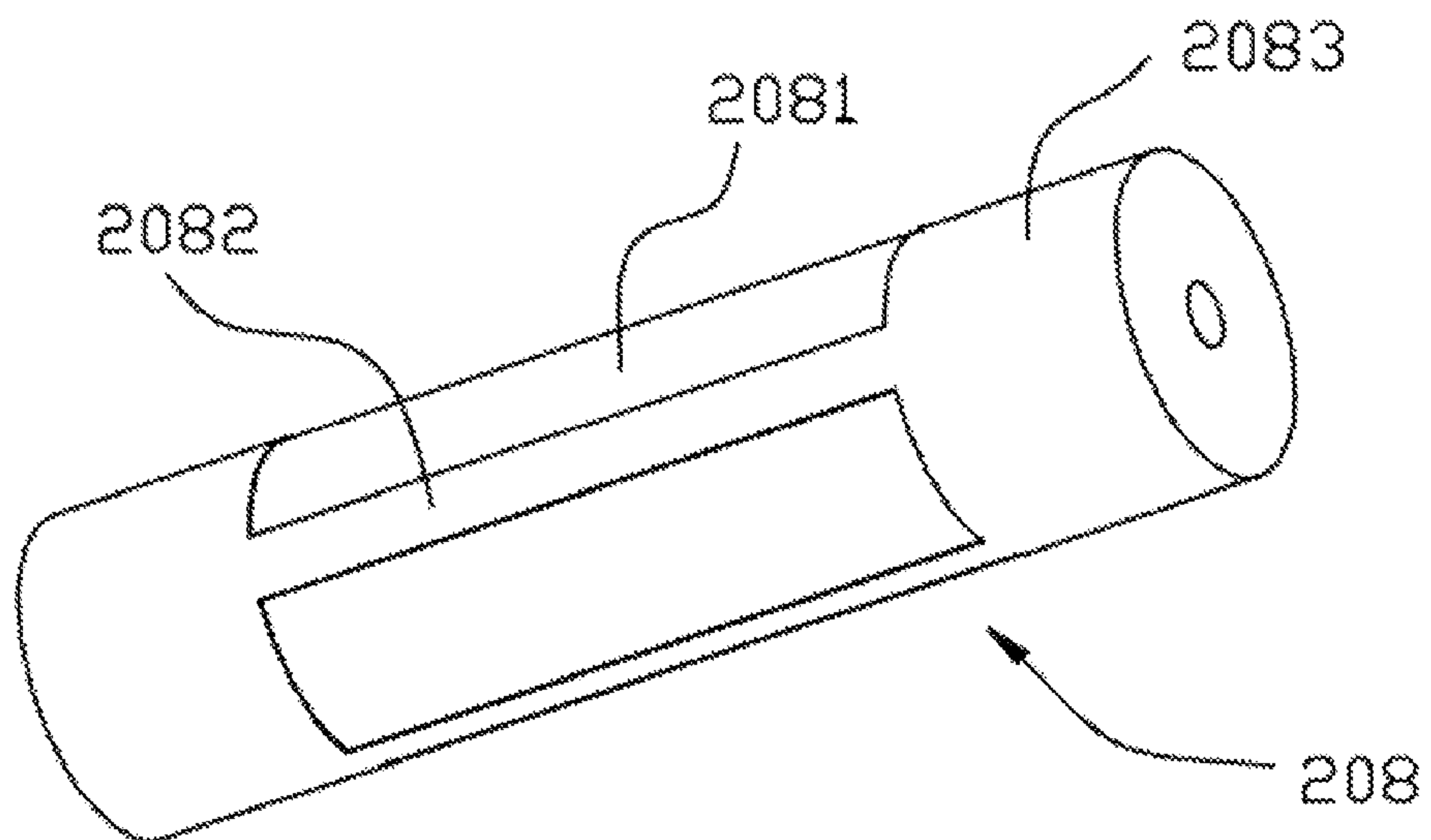


FIG. 6

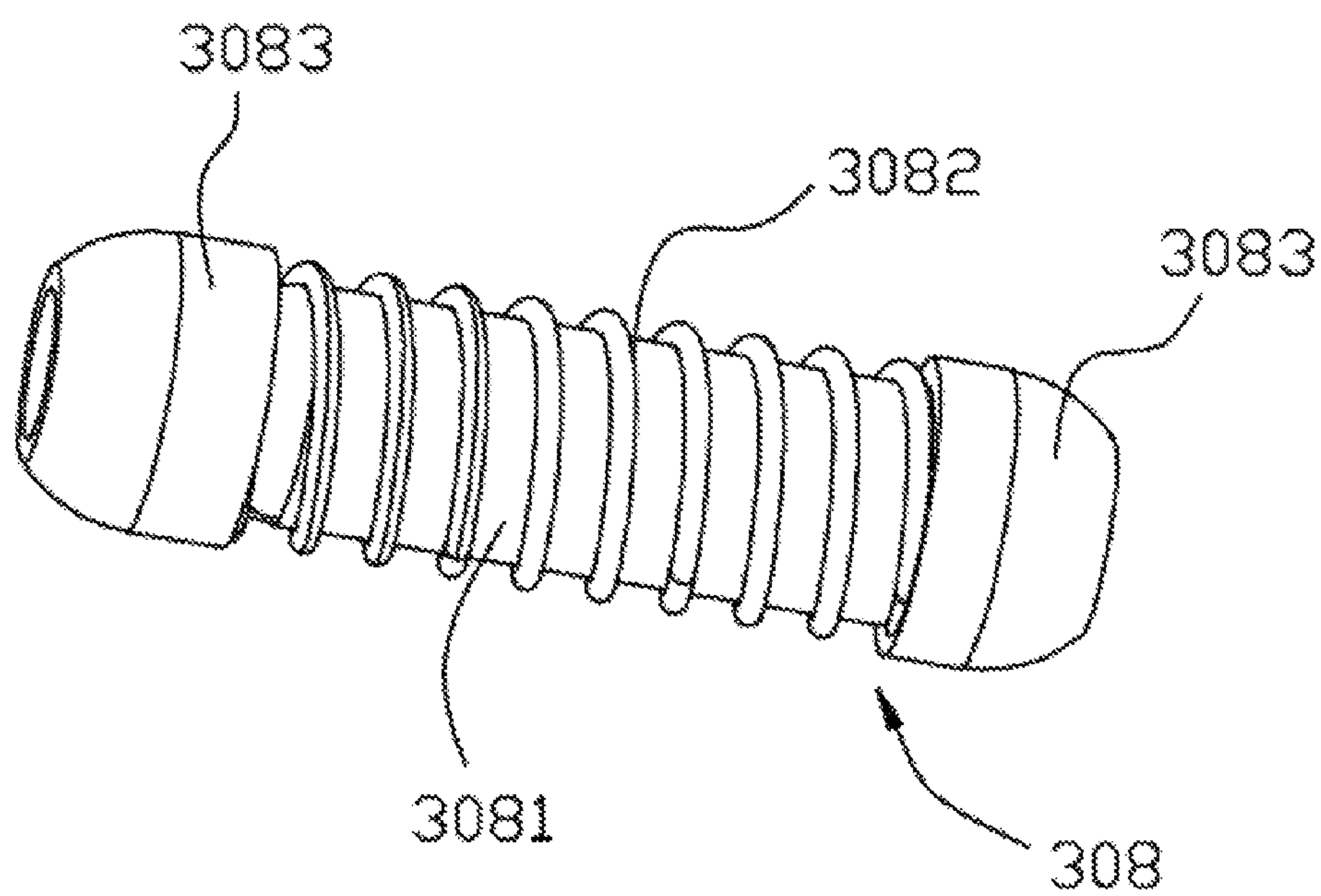


FIG. 7



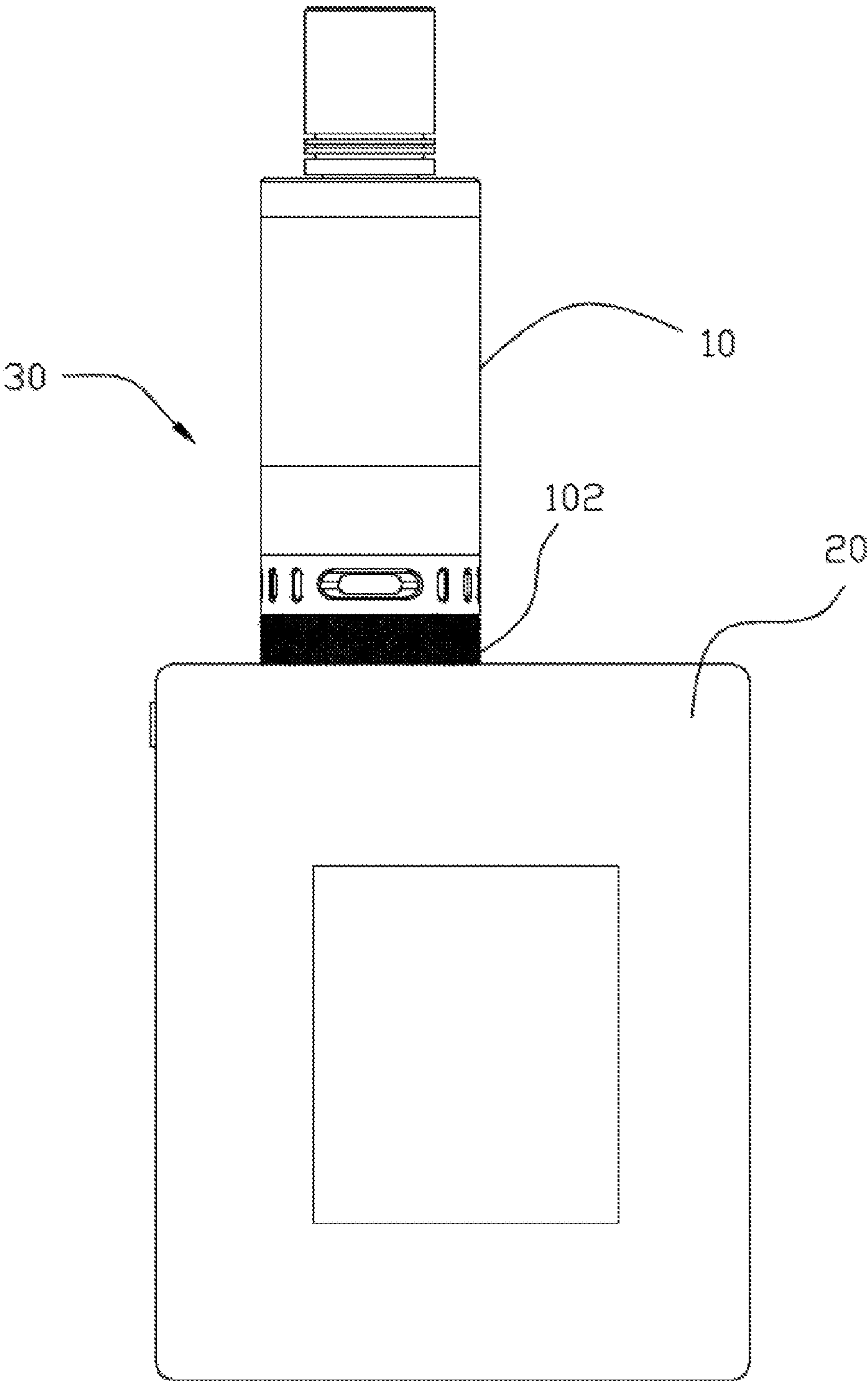


FIG. 8

# ATOMIZER AND ELECTRONIC SMOKING DEVICE HAVING SAME

## TECHNICAL FIELD

The present invention relates to electronic smoking devices, and particularly to an atomizer and an electronic smoking device using same.

## BACKGROUND ART

A typical heating assembly in an atomizer includes a liquid conducting body and a heating wire wrapped around the liquid conducting body. The liquid conducting body is usually made of glass fiber core. However, this kind of heating assembly may be unsuitable for atomizers of large wattage. For example, after assembling, a gap between the heating wire and a surface of the glass fiber core may be uneven. When the heating wire heats in large wattage, the glass fiber core may be burnt due to high temperature, thus rendering user experience unsatisfactory.

What are needed, therefore, are an atomizer and an electronic smoking device using same, which can overcome the above shortcomings.

## SUMMARY

An exemplary atomizer includes a housing, a conductive part at an end of the housing, a mouthpiece with an air outlet, a liquid chamber, and at least one heating element. The liquid chamber is in the housing and configured for storing tobacco liquid. The at least one heating element is electrically connected to the conductive part. The heating element includes a liquid carrier and a heating part integrally formed with the liquid carrier. The liquid carrier has a micro porous structure. The liquid carrier is in contact with the tobacco liquid. The liquid carrier is configured for absorbing the tobacco liquid, and the heating part is configured for heating the tobacco liquid to form aerosol.

## BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the present disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is a perspective view of an atomizer according to a first embodiment.

FIG. 2 is a cross-sectional view of the atomizer of FIG. 1.

FIG. 3 is an exploded perspective view of the atomizer of FIG. 1.

FIG. 4 is an assembled perspective view of a heating element and metallic brackets in the atomizer of FIG. 1.

FIG. 5 is the heating element of the atomizer of FIG. 1 according to the first embodiment.

FIG. 6 is a heating element according to a second embodiment.

FIG. 7 is a heating element according to a third embodiment.

FIG. 8 is a heating element according to a fourth embodiment.

## DETAILED DESCRIPTION

It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have

been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures and components have not been described in detail so as not to obscure the related relevant feature being described. Also, the description is not to be considered as limiting the scope of the embodiments described herein. The drawings are not necessarily to scale and the proportions of certain parts have been exaggerated to better illustrate details and features of the present disclosure.

The disclosure is illustrated by way of example and not by way of limitation in the figures of the accompanying drawings in which like references indicate similar elements. It should be noted that references to “an” or “one” embodiment in this disclosure are not necessarily to the same embodiment, and such references mean at least one.

Several definitions that apply throughout this disclosure will now be presented.

The term “outside” refers to a region that is beyond the outermost confines of a physical object. The term “inside” indicates that at least a portion of a region is partially contained within a boundary formed by the object. The term “substantially” is defined to be essentially conforming to the particular dimension, shape or other word that substantially modifies, such that the component need not be exact. For example, substantially cylindrical means that the object resembles a cylinder, but can have one or more deviations from a true cylinder. The term “comprising,” when utilized, means “including, but not necessarily limited to”; it specifically indicates open-ended inclusion or membership in the so-described combination, group, series and the like.

Referring to FIG. 1, an atomizer 10 is shown. The atomizer 10 is substantially cylindrical, and includes a housing 101, and a mouthpiece 103 and a conductive part 102 arranged at two opposite ends of the housing 101. A threaded part 104 is arranged on the conductive part 102, and configured (i.e., structured and arranged) for connecting with a power supply. A liquid chamber 109 for storing tobacco liquid and a heating element 108 for heating tobacco liquid are provided in the housing 101 (described in detail later). The housing 101 defines an air inlet 106. An adjusting ring 105 with adjusting holes 107 is further provided corresponding to the air inlet 106. The adjusting ring 105 is rotatable, such that an amount of air inflow can be adjusted by changing an area that the adjusting holes 107 overlap the air inlet 106.

Referring to FIG. 2, the housing 101 defines the liquid chamber 109. At least one heating element 108 is arranged in the housing 101, and is electrically connected with the conductive part 102. In the present embodiment, the atomizer 10 includes two heating elements 108. The heating element 108 includes a liquid carrier 1081 and heating part integrally formed with the liquid carrier 1081. The liquid carrier 1081 is in contact with tobacco liquid. The liquid carrier 1081 absorbs tobacco liquid, and conveys the tobacco liquid to the heating element 108 for atomization. The heating element 108 heats the tobacco liquid to form aerosol, and then the aerosol is expelled via an air outlet 1031 of the mouthpiece 103. The heating element 108 is integrally formed, and can absorb the tobacco liquid and heat the tobacco liquid. Accordingly, the heating element 108 has a simple structure, and it is convenient to assemble the heating element 108 into the atomizer 10.



In the present embodiment, quite usefully, the heating element **108** is sintered in a high temperature by nanosized metallic powder and a material of the liquid carrier **1081**, as seen in FIG. 5. The liquid carrier **1081** is made of a material selected from a group consisting of aluminum oxide, zirconium oxide, and silicone dioxide. In manufacturing, the nanosized metallic powder and agent of air bubbles are added into at least one of aluminum oxide, zirconium oxide, and silicone dioxide. Then the mixture is sintered in high temperature to form an integral structure. The aluminum oxide, zirconium oxide, or silicone dioxide forms the liquid carrier **1081** with porosity upon effect of the agent of air bubbles. The nanosized metallic powder is evenly dispersed in the liquid carrier **1081**, and molecules are interconnected to form a conductor with a certain resistance. In the present embodiment, the nanosized metallic powder may be selected from a group consisting of nickel, chromium, titanium, manganese, tungsten, molybdenum, and any combination thereof. The heating element **108** can heat uniformly, is suitable for atomizer of large wattage, and can absorb tobacco liquid due to its porosity. The heating element **108** can transfer tobacco liquid from two ends to a middle part, and heat the tobacco liquid to form aerosol. Further, to increase an amount of tobacco liquid the heating element **108** conducts, and to improve heating uniformity, the heating element **108** defines a liquid conducting hole **1082** extending axially.

Referring to FIG. 2, an atomizing chamber **110** is further defined in the housing **101**, and is separated from the liquid chamber **109**. A liquid inlet **118** is defined between the atomizing chamber **110** and the liquid chamber **109**. The air outlet **1031** is in communication with the atomizing chamber **110**. The heating element **108** is received in the atomizing chamber **110**. The atomizing chamber **110** is positioned below the liquid chamber **109**. The tobacco liquid flows out from the liquid inlet **118** and is then absorbed by the heating element **108**.

Referring to FIGS. 2-3, a top isolation cover **115** and a bottom isolation cover **114** are further provided in housing **101**. The top isolation cover **115** is configured for connecting to the mouthpiece **103**. The bottom isolation cover **114** is configured for isolating the atomizing chamber **110** from the liquid chamber **109**. The top isolation cover **115** and the bottom isolation cover **114** each include a tubular part **116** or **117**. The tubular parts **116**, **117** are interconnected to form an air passage **130** connecting the air outlet **1031** and the atomizing chamber **110**. In the present embodiment, the tubular parts **116**, **117** are coupled by screw threads, and by a sealing ring. The conductive part **102** and the sealing ring **105** are detachably connected with a lower part of the bottom isolation cover **114**. The conductive part **102**, the sealing ring **105** and the bottom isolation cover **114** cooperatively define the atomizing chamber **110**. The top isolation cover **115**, the bottom isolation cover **114**, and the housing **101** cooperatively define an annular space, served as the liquid chamber **109**. The liquid inlet **118** is defined in the bottom isolation cover **114**. In the present embodiment, two liquid inlets **118** are defined in the bottom isolation cover **114**.

Two metallic brackets **111** are further detachably provided in the atomizing chamber **110**. The two metallic brackets **111** are configured for fixing the heating elements **108**. The heating elements **108** are spaced apart from each other. The metallic bracket **111** defines liquid grooves **112** in alignment with the liquid inlet **118**. Two opposite ends of the heating element **108** are in contact with the metallic bracket **111**, and are positioned in the liquid grooves **112**. In assembly, the

metallic bracket **111** and the heating elements **108** as a whole are fixed on the bottom isolation cover **114** via screws **119**. Two opposite ends of the heating elements **108** extend into the liquid grooves **112** to absorb tobacco liquid. Two opposite ends of the heating elements **108** contact with the two metallic brackets **111**, respectively. The two metallic brackets **111** are both electrically conductive, and each is connected to a positive electrode and a negative electrode of the conductive part **102**. Quite usefully, the metallic brackets **111** are connected with the conductive part **102** via electrically conductive flat springs **120** (only one of them shown in the drawings). The electrically conductive flat springs **120** are fixed at a bottom part of the metallic brackets **111**.

Referring to FIG. 4, the two heating elements **108** are bridged between the two metallic brackets **111**, and are separated by a silicone holder **113**. Top ends of the metallic brackets **111** are fixedly connected by a cap **121**. The cap **121** defines an air hole **122** at a central part, which is spatially corresponding to the tubular part **117**. Accordingly, aerosol can enter the air passage **130**. The cap **121** further defines through holes **124** in communication with the liquid inlet **118** and the liquid groove **112**. The heating elements **108**, the metallic holder **111**, and the cap **121** are assembled as a heating assembly. The heating assembly can be assembled on the bottom isolation cover **114** conveniently. The caps **121** further define a plurality of screw holes **123** for assembling. The conductive part **102** is threadedly coupled to the bottom isolation cover **114**. After removing the conductive part **102**, the whole heating assembly can be replaced easily.

Referring to FIG. 6, a heating element **208**, according to another embodiment, is shown. The heating element **208** can replace the heating element **108** of the first embodiment. The heating element **208** includes a liquid carrier **2081** and a metallic heating layer **2082** printed on at least one part of a surface of the liquid carrier **2081**. Quite usefully, the liquid carrier **2081** is made of micro porous ceramic. Metallic resistance material slurry is printed on a surface of the micro porous ceramic using printing technology of circuit, and then the metallic material and the micro porous ceramic are together sintered. It is to be understood that the liquid carrier **2081** may be formed by sintering a mixture of agent of air bubbles and any of aluminum oxide, zirconium oxide, and silicone dioxide. Further, an electrically conductive layer **2083** is printed on the surface adjacent to two ends of the liquid carrier **2081**. The electrically conductive layer **2083** is electrically connected with the metallic heating layer **2082**.

Referring to FIG. 7, a heating element **308** according to an alternative embodiment is shown. The heating element **308** includes a liquid carrier **3081** and a heating wire **3082** wound around the liquid carrier **3081**. The heating element **308** further includes conductive caps **3083** arranged at two opposite end of the liquid carrier **3081**. The conductive caps **3083** are configured for connecting with two ends of the heating wire **3082**, and fixing the heating wire **3082** on the liquid carrier **3081**. It is noteworthy that in other embodiments, the heating wire **3082** may instead be a heating piece. Quite usefully, the liquid carrier **2081** is made of micro porous ceramic. It is to be understood that in other embodiments, the liquid carrier **3081** may be formed by sintering an agent of air bubbles and a material selected from a group consisting of aluminum oxide, zirconium oxide, and silicone dioxide.

Referring to FIG. 8, an electronic smoking device **30** is shown. The electronic smoking device **30** includes the above atomizer **10** and a power supply **20**. The power supply **20** is detachably connected with the atomizer **10**. The conductive part **102** is configured for electrically connecting to the



5

power supply 20. The power supply 20 includes buttons (not shown) configured for turning on/off the electronic smoking device 30, and adjusting an output wattage of the atomizer 10.

It is understood that the above-described embodiments are intended to illustrate rather than limit the disclosure. Variations may be made to the embodiments and methods without departing from the spirit of the disclosure. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the disclosure.

What is claimed is:

1. An atomizer, comprising:

a housing;

a conductive part at an end of the housing;

a mouthpiece with an air outlet;

a liquid chamber in the housing and being configured for storing tobacco liquid;

at least one heating element electrically connected to the conductive part, the heating element comprising a liquid carrier and a heating part integrally formed with the liquid carrier, the liquid carrier having a micro porous structure, the liquid carrier being in contact with the tobacco liquid, the liquid carrier being configured for absorbing the tobacco liquid, the heating part being configured for heating the tobacco liquid to form aerosol; and

an atomizing chamber in the housing, wherein the atomizing chamber is separated from the liquid chamber, the atomizer further defines a liquid inlet between the atomizing chamber and the liquid chamber; the air outlet is in communication with the atomizing chamber, and the heating element is arranged in the atomizing chamber;

wherein the atomizer further comprises two metallic brackets detachably arranged in the atomizing chamber, the metallic brackets are configured for fixing the heating element, each metallic bracket defines a liquid groove aligned with the liquid inlet, ends of the heating element are in contact with the metallic brackets, and are positioned within the liquid grooves.

2. The atomizer according to claim 1, wherein the heating element is made of an identical material, is formed by sintering nanosized metallic powder and a material of the liquid carrier in a high temperature.

6

3. The atomizer according to claim 2, wherein the liquid carrier is made of a material selected from a group consisting of aluminum oxide, zirconium oxide, and silicone dioxide.

4. The atomizer according to claim 1, wherein the heating part is a metallic heating layer printed on at least one part of a surface of the liquid carrier.

5. The atomizer according to claim 1, wherein the heating part is a heating wire wound around the liquid carrier, the liquid carrier comprises two opposite ends, the heating element further comprises two conductive caps arranged at two ends of the liquid carrier respectively, and the conductive caps are configured for connecting two opposite ends of the heating wire, and fixing the heating wire on the liquid carrier.

6. The atomizer according to claim 4, wherein the liquid carrier is made of micro porous ceramic.

7. The atomizer according to claim 1, wherein the metallic brackets are electrically connected with the conductive part via an electrically conductive flat spring.

8. The atomizer according to claim 1, further comprising a top isolation cover and a bottom isolation cover both arranged in the housing, wherein the top isolation cover and the bottom isolation cover each comprise a tubular part, the top isolation cover is configured for connecting the mouthpiece, the bottom isolation cover is configured for separating the liquid chamber from the atomizing chamber, and the tubular parts of the top and bottom isolation covers are interconnected to form an air passage connecting the air outlet and the atomizing chamber.

9. The atomizer according to claim 1, wherein the housing defines an air inlet, the atomizer further comprises an adjusting ring adjacent to the air inlet, the adjusting ring defines a plurality of adjusting holes corresponding to the air inlet; the adjusting ring is rotatable, such that an amount of air inflow can be adjusted by changing an area that the adjusting holes overlap the air inlet.

10. An electrically smoking device, comprising:

an atomizer according to claim 1; and

a power supply detachably connected with the atomizer, the power supply being configured for supplying the atomizer power.

\* \* \* \* \*